Active Control of Cable Bridges Using Fuzzy Logic

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The response of a high-rise building and Suspension Bridge to dynamic forces such as earthquake and wind loads has been of primary interest to civil engineers. In the last two to three decades, control devices, passive as well as active, have been developed to suppress structural vibration due to these environmental disturbances. Among the concepts behind the development of these devices. The one based on the use of a mass as an added energy-absorbing system has been under rather intensive study, and the results have been fruitful (MCNamara 1977). Luft (1979), Ayorinde and Warburton (1980) presented approximated formulas for the optimal parametric design of a tuned-mass-damper (TMD) system.

In an attempt to increase the effectiveness of a TMD system, Chang and Song (1980) introduced an active force to act between the structure and the TMD system. The active systems in recent years been extensively taken into attention. Between the active controlling systems method can be called the ATMD method. To date, various strategies have been proposed for determining the active control force that some methods may be used in some structures.

A process for designing an effective active-tuned-mass damper (ATMD) system to control a tall building and Suspension Bridge subjected to stationary random wind forces was proposed by Abdel-Rohman (1984) using the pole- assignment method. The results suggested that the design of an optimal ATMD required at least a parametric study to select the ATMD parameters In this study, to determine the optimal ATMD active force control system we used the LQR algorithm and fuzzy controller. The structure is a Suspension bridge that its vertical vibration under earthquake loads in two modes, without control and controlled is studied.

Keywords: Active Tuned mass damper (ATMD), Tuned mass damper (TMD), Fuzzy Logic controller, LQR algorithm, Suspension Bridge